

OUR ASTRONOMICAL COLUMN

CACCIATORE'S SUPPOSED PLANET OF 1835.—It might have been expected that long ere this, if the object twice observed at Palermo in May, 1835, were really a planet, it would have been recovered by one or other of the astronomers who have occupied themselves with the examination of the ecliptical region of the sky.

The particulars of the Palermo observations were communicated by Cacciatore to Valz in a letter dated September 19, 1836, and at an earlier period to the late Admiral Smyth, as will be known to readers of the "Cycle of Celestial Objects." Valz sent a copy of Cacciatore's letter to Schumacher, who published it in No. 600 of the *Astronomische Nachrichten*. When observing the star 503 of Mayer's catalogue with the Ramsden circle, on May 11, 1835, it was noted down that a smaller star of the eighth magnitude followed Mayer's star two seconds of time, and was about $2\frac{1}{2}'$ to the south. Such entries were frequently made by Piazzi, when observing with the same instrument, as may be seen from his catalogue, but although No. 503 occurs there, no mention is made of a star near it. On the next fine night, May 14, observing Mayer's star again, the assistant, according to custom, read out the note made on May 11: "Seguita da una altra di 8 per 2' circa di A.R. circa $2\frac{1}{2}'$ al sud." No star was then visible in this position even in a dark field, but one of the eighth magnitude preceded Mayer's star nine seconds of time, only $1\frac{1}{3}'$ to the south. Cacciatore says he intended to repeat the observation on the following evening, the weather promising to continue fine. Returning to the library he found that no one of the four small planets known at that time was in the observed position, and he appears to have considered the object either a planet beyond Uranus or a comet, remarking: "Onde con impazienza attendeva il dimani." But the night of May 15 proved unfavourable, rain setting in, followed by clouded skies for upwards of a fortnight, and not until June 2 could an observation be attempted, "Ma la stella era involta nel crepuscolo feci varj tentativi fuori del méridiano, non transcurrai ogni mezzo per riconoscere la mia osservazione." Cacciatore says his assistants were unsuccessful on other evenings to the end of June. The search was repeated in the first five months of 1836, but to no purpose.

Valz first showed that a body with the observed positions on May 11 and 14, could not be a distant planet, as Cacciatore had conjectured, but rather a pretty near member of the minor-planet group, which, on the hypothesis of a circular orbit, might have a period of revolution of about three years, with the ascending node of the orbit in longitude $339^{\circ} 36'$ and an inclination of $3^{\circ} 22'$ to the plane of the ecliptic. In 1849 Dr. Luther repeated the calculation with the following results:—Radius of orbit, $2'1055$; ascending node, $343^{\circ} 20'$; inclination, $3^{\circ} 37'$; period, 1,116 days; and from these elements Oeltzen computed a *zodiac* for the planet, or a table indicating with right ascension as argument, the northern and southern limits of declination (*Astron. Nach.*, No. 662). It is certain that any determination of the position of the orbit from Cacciatore's data must be open to considerable uncertainty, and hence a search for his supposed planet amongst the one hundred and eighty-eight planets now discovered would not be decisive one way or the other if confined to similarity in the position of the nodes and the inclination; places must be calculated for the epoch of Cacciatore's observation for such planets as could by possibility pass near Mayer's star. An attempt in this direction has failed to identify the object. That a minor planet which so far from opposition attains the brightness of stars of the eighth magnitude can still remain unknown to us is, to say the least, very improbable. Must we leave Cacciatore's star in the same category as those reported to have been observed by Huth in 1801 and

Reissig in 1803, to which reference has been made in this column?

THE TOTAL SOLAR ECLIPSE OF 1883, MAY 6.—In continuation of our notices of the total eclipses of the sun during the remainder of the present century, we present the elements of the eclipse of May 6, 1883:—

G.M.T. of conjunction in R.A., May 6, at 9h. 44m. 42s.

R.A.	43 $30' 52''$
Moon's hourly motion in R.A.	38 $22' 6''$
Sun's	2 $25' 0''$
Moon's declination	16 $11' 32''$ N.
Sun's	16 $37' 52''$ N.
Moon's hourly motion in declination	7 $26' 2''$ N.
Sun's	0 $41' 9''$ N.
Moon's horizontal parallax	60 $52' 0''$
Sun's	8' 8"
Moon's true semi-diameter	16 $35' 2''$
Sun's	15 $51' 0''$

The central and total eclipse begins in longitude $156^{\circ} 1' E.$, latitude $34^{\circ} 43' S.$, and ends in $86^{\circ} 44' W.$ and $13^{\circ} 41' S.$, and the central eclipse occurs with the sun on the meridian in $147^{\circ} 4' W.$, and $9^{\circ} 11' S.$ The following are also points upon the central line:—

Long. $179^{\circ} 51' E.$ Lat. $25^{\circ} 43' S.$	Long. $137^{\circ} 44' W.$ Lat. $6^{\circ} 24' S.$
" 168 $19' W.$ " 19 $52'$	" 119 $52' W.$ " 5 $51'$
" 160 $49' W.$ " 15 $49'$	" 108 $12' W.$ " 7 $51' S.$
" 140 $51' W.$ " 7 $7S.$	

The path of the eclipse is almost wholly a sea-track, and the only probable region for obtaining observations of any value will be in the Marquesan longitudes. A direct calculation for the island Fetou-houhou or Chanel Island, with the position of the Admiralty chart, gives for commencement of totality oh. 42m. 3s. local mean time, and duration of the total phase 2m. 53s. The following are the limits of the zone of totality about the Marquesas group:—

Longitude W.	South limit, Latitude.	North limit, Latitude.
141° ...	$8^{\circ} 11' S.$	$6^{\circ} 2' S.$
140° ...	$7^{\circ} 55' S.$	$5^{\circ} 46' S.$
139° ...	$7^{\circ} 41' S.$	$5^{\circ} 31' S.$
138° ...	$7^{\circ} 25' S.$	$5^{\circ} 16' S.$

NOTES

DR. SCHUSTER, the leader of the English Government Eclipse Expedition to Siam, in 1875, sails in the White Star Line ship *Germanic* to-day to observe the eclipse of the 29th instant. Prof. Thorpe, F.R.S., accompanies him on the same errand, and will make magnetic observations over a great portion of his route. Mr. Norman Lockyer intends to sail in the *Baltic* on the 9th instant. We learn that the appropriation made by the American Government is so small that, in strange contrast to what has happened in the case of all English Expeditions since 1870, no facilities can be offered officially to observers from other countries. Still we doubt not that they will receive both welcome and aid from their *confrères*.

CAPT. MOUCHEZ has been appointed Director of the Paris Observatory. A sub-director has also been appointed, but contradictory reports have reached us as to who has been selected.

A LARGE number of foreign men of science have promised to be present at the Dublin meeting of the British Association; among the names mentioned at the last meeting of the local committee are Professors Sachs, Würzburg; C. Pierce, New York; S. H. Scudder, Cambridge, Mass.; A. S. Packard, Salem, Mass.; and Karl Koch, Berlin. The programme of excursions will be finally settled at the next meeting of the committee. Visits to almost every place of interest within easy distance of the city will be arranged for, and the

usually vexing questions of locomotion and commissariat carefully attended to. The gentlemen of the Excursion Committee are sparing neither time nor trouble to work out the exceedingly difficult task they have undertaken in a thoroughly satisfactory manner. A report from Professors M'Nab and Macalister, editors of the "Guide Book," was read, and shows that the little volume will be a most interesting one. It will consist of sixteen parts, embracing every subject of scientific interest, and will have the following maps:—The six-inch map of the City of Dublin, the ten mile to the inch map of the province of Leinster, and a geologically coloured map of the country, on a scale of a quarter of an inch to the mile. The maps are being prepared under the direction of Major Wilkinson, chief of the Ordnance Survey in Ireland.

AMONG the excursions arranged for in connection with the approaching Paris meeting of the French Association are the following: On August 24, to Fécamp and Etretat; 28th to Tancarville Château, the Roman remains at Lillebonne, and the manufactures of Bolbec; on the 31st to Rouen, returning by steamer to Paris.

THE following is a list of the scientific conferences still to be held in connection with the Paris Exhibition:—Demography, July 5-9; Ethnography, July 15-17; Means of Transport, July 22-27; Hygiene, August 1-10; Civil Engineering, August 5-14; Anthropology, August 15-21; Commerce and Industry, August 16-22; Meteorology, August 24-28; Geology, September 2-4.

THE distribution of the medals of the Paris Geographical Society at the Sorbonne on Friday was witnessed by an immense crowd which had gathered to hear Mr. Stanley, who was received with tremendous enthusiasm. His address, in which he carefully expounded the state of African exploration when he began his work, was delivered in English, and a translation read in French by M. Maunoir, the general secretary of the Society. [The meeting was presided over by Admiral La Roncière le Nourry, who spoke in English when he handed over the gold medal to the great African explorer. Stanley returned thanks in English. These two addresses were not translated as it became evident a large number of the audience understood the proceedings. The other medals to M. Vivien De St. Martin and Dr. Harmand were then delivered.

AT the Paris *fête* of June 30 the part played by electricity was smaller than anticipated. The number of electric lamps was large, but the effect not particularly good. The Jablkhoff candles, although superior to gas-lamps, were not sufficient to overcome all the mass of light which surrounded them. A large number of Bunsen elements had been put into requisition, but the regulators were wanting in regularity, and much of the effect was consequently lost. Competent persons say that the result would not have been so poor if previous successes had not raised too ambitious expectations in the public and too much confidence in the operator.

THE position in the physical section of the French Academy of Sciences, rendered vacant by the death of Becquerel in January last, has been filled by the election of M. A. Cornu. The recipient of this honour is best known by his investigations into such fundaments as the density of the earth and the velocity of light. Among his other researches of more recent date we might mention those "On the Experimental Determination of the Principal Elements in an Optical System," and "On the Optical Polarisation due to the Reflexion on the Surface of Transparent Bodies." M. Lecoq de Boisbaudran has been elected a Corresponding Member in place of the late M. Malaguti.

PROF. A. W. HOFMANN, of Berlin, has passed through a severe attack of fever during the past month, and, although

now out of danger, will be for some time unable to fulfil the active duties of his position. A handsome brochure has lately appeared, commemorating the grand *commers* given in honour of his sixtieth birthday, by the students of Berlin, last March.

AT the general meeting of the Scottish Meteorological Society to-morrow Dr. Mitchell and Mr. Buchan will read a paper comparing the weather and health of New York with London; and Mr. Buchan another on the influence of the physical configuration on the seasonal distribution of the Scottish rainfall.

MR. EDWYN C. REED, well known to many English zoologists from the collections he has from time to time forwarded from Chile, and author of several papers on the entomology of that country, has left his post in the Museum of Santiago and accepted the appointment of Professor of Zoology in the "Liceo" of Valparaiso, and Director of its Museum. Mr. Reed sends us copies of two papers which he has recently published at Santiago, one on the Diurnal Lepidoptera of Chile, the other on the Mammals and Birds of the hacienda of Cauquenes, in the province of Colchagua. Both of these deserve the attention of European naturalists.

THE completion of Giffard's large captive balloon has been postponed owing to the bad weather which prevailed in Paris during the greater part of June, but the recent fine weather has enabled the works to be resumed and the balloon will be completed in a few days. On the occasion of the *fête* of June 30, a balloon of 17,000 cubic feet was sent up with two aeronauts. It was filled in forty minutes with hydrogen gas generated with M. Giffard's continuous apparatus, which contrivance is in perfect order, and will be used this week to fill, in about two days, the monster of 25,000 cubic feet.

THE Birmingham Natural History and Microscopical Society have decided to have this year again a marine excursion to Arran. Facilities will be afforded both for dredging excursions in Lamlash and Brodick Bays and elsewhere in the vicinity; and for land excursions to investigate the botany and highly interesting geology of the island. During the summer season a most interesting series of observations may be made on the microscopic larval forms of marine life (hydroids, echinoderms, crustaceans, annelids, &c.) which abound in the sea, and may at this time readily be taken by the tow net. The late season of the year when the previous excursions have been made precluded much attention to this most interesting branch of marine zoology, which will be specially studied on this occasion. Should a sufficient number join the excursion it is hoped that a small steamer may be chartered, which will economise time and add to personal comfort. The time for the excursion will be from about the 19th to the 27th of July, but the days will be positively fixed at a meeting of those who are desirous of joining the excursion. The expense will be very moderate, and the Birmingham Society deserve every credit for their enterprise.

THE committee who are charged with the arrangements for the celebration of the fiftieth anniversary of the opening of University College desire to make known that ladies will be admitted to the festival on the same terms as gentlemen. Many ladies have already obtained tickets, and others, who may desire to do so, will find full particulars in the advertisement now appearing in our columns. Among those who have accepted the invitation of the committee are the Earl and Countess of Granville, the Earl of Derby, the Earl of Northbrook, the Earl Fortescue, Lord and Lady Ebury, Lady Belper, Mr. and Mrs. Goschen, Sir John and Lady Lubbock, &c., &c.

"THE aforesaid Martin was one of those unfortunates who were at that time of day (and are, I fear, still) quite out of their places at a public school. If we knew how to use our boys, Martin would have been seized upon and educated as a natural

philosopher." So writes "Tom Brown." Our thoughts reverted to the above description whilst considering the contents of some recent numbers of the *University College School Magazine*. Our present purpose is not to give an account of this Magazine, which, we remark, appears at uncertain intervals, and contains articles of like character with those found in most similar school publications. But we desire to draw attention to the formation of a "scientific society" amongst the boys themselves. This was started in January, 1876. At first the members read quasi-original papers once a week, and then a discussion took place upon the same; in May of the present year it was resolved to have papers twice a week. At the outset a library was started, books being presented by the members, and in the Michaelmas term of 1877 a reading-room was opened for use between morning and afternoon school, four days in the week. Amongst the scientific papers taken in, we notice that NATURE heads the list. In the present year a museum has been started, and we give particulars, as doubtless some old U.C.S. boy may be able to add to it for "auld lang syne." It contains a collection of minerals, fossils, metals, &c.; specimens illustrative of economic botany; ethnological implements, weapons, coins, &c.; osteological specimens; marine shells; a Tennant's geological box (200 specimens); and a case of British birds' eggs. The working staff is composed partly of the boys and the terminal subscription is a shilling. The privilege of membership (subject to a ballot) is restricted to the fourth and higher science classes. It will be seen that it is yet the "day of small things" with the Society, but we predict for it considerable usefulness. Had such a society existed at Rugby in the days of "Martin," each would have been made for the other. Papers have been read on "Carbon Dioxide as a Motive Power," "Voltaic Electricity," "Frictional Electricity," "Electro-Magnetism," "Cyclones," the Barometer, the Thermometer, Comets, Coral, &c. The Society fosters study further by offering to its members every year three prizes, awarded at the annual distribution, for the best collection of natural objects and of microscopical objects, and for the best model of any scientific instrument—all these to be made or mounted by the exhibitor. We believe the usefulness of the Society might still further be increased could its council induce leading scientific men to deliver lectures which should be open to the friends of members and of the boys generally. We are sure the present head and vice-masters would lend their countenance to such a proceeding.

FRANCE was visited by an earthquake on June 25, which was felt at Lyons, Mâcon, Valence, Villefranche, and Châlons. The movement was from the east towards the west. The shock lasted half a minute, but caused no damage.

PROF. BURDON SANDERSON delivered the Harveian oration on June 26. He occupied himself with the researches by which, in the first half of the present century, the Harveian doctrine of the working of the circulatory apparatus was developed.

A FINE colossal bronze statue of Capt. Cook, by Mr. Woolner, R.A., which is at present placed in the open space between the United Service Club and the Athenæum, is intended for erection at Sydney, New South Wales.

THE Council of the Sanitary Institute of Great Britain have appointed a committee, consisting of His Grace the Duke of Northumberland, president, Mr. Edwin Chadwick, C.B., Dr. Richardson, F.R.S., and Dr. Lory Marsh, to represent the Sanitary Institute at the Congrès International d'Hygiène in Paris, from the 1st to the 10th of August next. During the congress in Paris the Société Française d'Hygiène, with which the Sanitary Institute is affiliated, will entertain at a banquet on August 9 the members of the Sanitary Institute and their other foreign associates.

WE have received from the Imperial College of Engineering,

Tokei, Japan, the Calendar for Session 1877-8, and the reports of the professors for the period 1873-77. We have already referred to this admirably conducted institution so fully already (vol. xvi. p. 44), that we need only say now that these publications confirm all we have said about the college. It is based on the best continental models, and the course of instruction is so complete, thorough, scientific, and practical, that English engineering students who read the syllabus of instruction, the list of contents of the museum, the catalogue of the admirable library, and the professors' reports, will be inclined to wish that Japan were a little nearer home. The enthusiasm and discrimination which the Japanese have shown in adopting all the best characteristics of European civilisation and learning, are one of the wonders of the age; they have been specially fortunate in obtaining as principal of their Engineering College, so intelligent and accomplished a man as Mr. Henry Dyer has shown himself to be. Among the professors are Messrs. J. Perry and W. E. Ayrton, whose names must be known to many of our readers as the authors of valuable original papers in physics, sent by them occasionally to this journal and to the scientific societies.

MR. CONSUL LAYARD, of Noumea, sends to the *Colonies* particulars of extraordinary volcanic eruptions at the island of Tanna in the beginning of the year. The first eruption took place on January 10 last, about 10 A.M. The bottom of the harbour at the west side rose above water for about fifty fathoms length at the first earthquake shock. A new volcano burst out close to "Sulphur Bay," between it and the old volcano. The west side of Port Resolution was all bursting up with steam. A second great eruption and earthquake took place on February 11, and the bottom of the harbour was again upheaved for about another fifty fathoms, making the entrance of the harbour very narrow. Three rocks rose up about a cable's length from the west point to seaward out of eleven fathoms water. There is now a bar with only fifteen feet of water, where there used to be five or five and a half fathoms, right across the mouth of the harbour, a little inside. A tidal wave about fifty feet high swept the east point of the harbour; destroying all the native plantations. The wave occurred on both occasions, but the first was the biggest. The old mountain was very active, roaring and throwing up huge rocks. The tidal wave was very local; so was the shock. The missionary on the other side of the island hardly felt it, and there was no wave there. The natives say they never knew anything like it before. On the west side the earth has cracked and sunk very considerably; on the east side the land was swept by the tidal wave; the plantations on both sides are destroyed.

THE glaciers of the Western Himalayas, according to measurements recently given in the *Tour de Monde*, far surpass in extent any hitherto examined outside of the polar regions. In the Mustagh range, two glaciers immediately adjoining one another possess a united length of sixty-five miles. Another glacier in the neighbourhood is twenty-one miles in length, and from one to two miles in width. Its upper portion is at a height of 24,000 feet above the level of the sea, and its lower portion terminating in masses of ice 250 feet in height, and three miles in breadth, is 16,000 feet above the sea.

SOME interesting fossils have just been found near Holmenstrand, on the Bay of Christiania, Norway. They consist of large quantities of dolphin bones and are imbedded in loam some three metres below the present surface, although more than forty-three metres above the level of the sea. Their surroundings are unquestionably of the most recent geological formation, and this discovery may serve as a proof that even during the latest geological period the coast of Southern Norway has risen at least forty-three metres. Not a single fossil of the piocene or pleistocene has been found.

M. J. S. POLIAKOW, of the Russian Geographical Society, is about to commence his researches in the government of Vladimir and in Lithuania into the remains of the stone period. This expedition is in continuation of the labours of M. Poliakow, commenced more than ten years ago by the discovery of implements of stone in the plane of the river Irkout (1867). Later, in 1871, he found implements of the same kind in the government of Olonets, on the banks of Lakes Lago, Kenozero, &c.; in 1874 he found them also on the banks of the lakes of the upper basin of the Volga; and lastly, the journey which he undertook in 1876, in the valley of the Obi, convinced him not only of the existence of remains of the stone period in Western Siberia, but led him to seek the explanation of many stone implements among the implements of peoples possessing only a low degree of culture, as among the Ostiaks. This series of journeys has enabled M. Poliakow to form a very considerable collection of implements in stone and of curious data on the natural history of that epoch. Now, new discoveries have been made by other travellers in the districts of Mourom, Vladimir, and in Estonia, on the banks of Lake Bourtnek, where a tumulus has been discovered containing remains of objects connected with cookery. All these discoveries have led M. Poliakow to request the Society to send him into the government of Vladimir and into Estonia, to study upon the spot these new remains. What attracts the attention of M. Poliakow is that there are, among other things, proofs that, during the stone period, there existed in the small fresh-water lakes a species of seal recalling, by its dimensions and characteristics, the seal of Greenland and the Caspian. Another remarkable fact is the discovery made, along with the instruments of stone in the district of Mourom, remains of the mammoth. After having investigated the materials referred to, M. Poliakow proposes to visit Stockholm, Copenhagen, and other cities, to inspect the pre-historic museums, with a view to complete the materials he possesses for studying the stone period.

DR. SCHOMBURGK, in his Report on the Botanic Garden and Government Plantations of South Australia for 1877, gives an account of an interesting experiment he made with some Arctic wheat. He received a sample of wheat taken from a quantity left by the American Arctic Expedition ship *Polaris* in 1871, which had been abandoned in north latitude $81^{\circ} 16'$. This wheat had been left on the beach exposed to the snow and a temperature of 72° to 104° of frost for five years, and was found in a heap by Dr. Ninnis, of H.M. ship *Discovery*, on the return of the last Arctic Expedition to England. Dr. Schomburgk received 1,000 grains, of which he sowed about 300. From the 300 grains about sixty germinated. The plants grew healthy and reached to the height of from three to four feet. It is a bearded wheat, and ripened in the commencement of January. The ears contained about thirty grains each, which were but small, though round and plump. The birds unfortunately destroyed the greater part before it came to maturity, but the interesting fact proves the assertion that the grain of the cereals possesses a vitality not surpassed by any other seed.

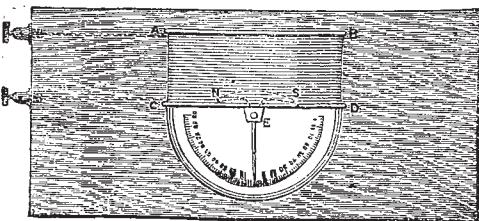
THE additions to the Zoological Society's Gardens during the past week include a Japanese Wolf (*Canis hodophylax*) from Japan, presented by Mr. H. Heywood Jones; a Rhesus Monkey (*Macacus Erythraeus*) from India, presented by Mrs. Walcot; a Brown Capuchin (*Cebus fatuellus*), a Crested Curassow (*Crax alector*) from Venezuela, presented by Mr. A. Warmington; a Mona Monkey (*Cercopithecus mona*) from West Africa, presented by Capt. C. F. Filliter; a Green Monkey (*Cercopithecus callitrichus*) from West Africa, presented by Mrs. George Yeomans; a Common Marmoset (*Hapale jacchus*) from South East Brazil, a Pinche Monkey (*Alidus adipus*) from New Granada, presented by Mr. Edward Clayton; a Bonnet Monkey

(*Macacus radiatus*) from India, presented by Mr. Allen Forbes; a Short-Tailed Capromy (*Capromys brachyurus*) from Jamaica presented by the Hon. J. Burford Hancock; a Pine Marte, (*Martes abietum*) from Ireland, presented by Mr. Robert Walter; six Goldfinches (*Carduelis elegans*) British Isles, a Common Chameleon (*Chamaeleon vulgaris*) from North Africa, presented by Mr. C. F. Johnson; four Cunningham's Skinks (*Egernia cunninghamii*) from Australia, presented by Mr. D. C. Pearson; a Garden's Night Heron (*Nycticorax gardeni*), a Common Boa (*Boa constrictor*) from South America, purchased; a Green-necked Peafowl (*Pavo spiceri*) bred in the Gardens.

A NEW GALVANOMETER FOR LECTURE PURPOSES

ALL who have had the experience of attempting to exhibit to a large audience the simple phenomena of dynamical electricity will bear testimony to the difficulty of rendering apparent over the whole of a lecture-theatre the movements of a galvanometer needle. When the galvanometer lies flat upon the table and the movements of the needle itself, or of the index attached to it are observed, the number of observers must be confined to those near at hand. Even the mirror galvanometer, indispensable as it is for delicate experiments, is open to the objection that a popular audience does not immediately appreciate the significance of the motions of the wandering spot of light. The devices for projecting the moving needle upon the screen have, up to the present time, been so large and inconvenient as to militate against their use for popular demonstration.

These facts led the writer some months ago to attempt to construct an instrument for projection upon the screen that should be within the size of an ordinary magic-lantern slide. The early attempts to do this were unpromising, and possessed little sensitivity even for considerable currents. In the latest form of the instrument, however, this defect has been overcome, and the galvanometer has in several trials before large popular audiences, as well as in the teaching of the lecture-room, shown itself to



answer with complete satisfaction the purposes for which it was designed.

In the most improved form, the galvanometer consists of a mahogany block the size and thickness of an ordinary magic lantern slider, which serves as a frame to contain the working parts. The coil of wire is wound upon a flat bobbin of brass or ivory, its ends being brought to a pair of terminals at the extremity of the slider. Within the coil the magnetised needle is suspended delicately by a horizontal axis between two adjustable screws. Attached at right angles to the needle is a light index of thin brass or of aluminium. The scale, which is transparent, is reduced by photography upon a glass plate. The arrangements are therefore on a small scale like those of a Becquerel's vertical galvanometer inverted. When no current passes, the index arm hangs downward, the centre of gravity being adjusted very little below the centre of suspension so as to secure the greater degree of sensitivity. But to correct for the dip when the plane of the instrument is nearly in the meridian a small compensating magnet may be placed upon the table below. Thus the slightest movement of the needle is at once made visible by the motion of the magnified image of the scale and index; and will be quite apparent even without lowering the lights of the room.

As the instrument may be constructed with either a short-coil or a long-coil, it can be applied to a variety of experimental uses. And its portability and simplicity exceed those of any galvanometer hitherto employed for purposes of demonstration.

SILVANUS P. THOMPSON